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ARS 907 (2012) (English): Fresh jackfruit
-- Specification



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Fresh jackfruit — Specification



Draft African Standard

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Introduction

The jackfruit (*Artocarpus heterophyllus*) is a species of tree in the *Artocarpus* genus of the mulberry family (*Moraceae*).

Jackfruit is commonly used as food in cultures. It can be eaten unripe (young) when cooked, or ripe uncooked. The seeds may be boiled or baked like beans.

The multiple uses of jackfruit is of special significance to African interests in terms of fulfilling many functions such as food security, wood uses and forestry needs. This African Standard was prepared to provide requirements necessary to facilitate trade for fruits and vegetables noting the significance of these products in agriculture and rural development as well as poverty alleviation.

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Fresh jackfruit — Specification

1 Scope

This Standard applies to commercial varieties of jackfruit grown from *Artocarpus heterophyllus* Lam., of the Moraceae family to be supplied fresh to the consumer. Jackfruit intended for industrial processing and cooking is excluded.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ARS 53, *General principles of food hygiene — Code of practice*

ARS 56, *Prepackaged foods — Labelling*

CAC/GL 21, *Principles for the establishment and application of microbiological criteria for foods*

CAC/RCP 44, *Recommended international code of practice for the packaging and transport of tropical fresh fruits and vegetables*

CAC/RCP 53, *Code of hygienic practice for fresh fruits and vegetables*

CODEX STAN 193, *Codex general standard for contaminants and toxins in food and feed*

ISO 874, *Fresh fruits and vegetables — Sampling*

ISO 2169, *Fruits and vegetables — Physical conditions in cold stores — Definitions and measurement*

ISO 6561-1, *Fruits, vegetables and derived products — Determination of cadmium content — Part 1: Method using graphite furnace atomic absorption spectrometry*

ISO 6561-2, *Fruits, vegetables and derived products — Determination of cadmium content — Part 2: Method using flame atomic absorption spectrometry*

ISO 6633, *Fruits, vegetables and derived products — Determination of lead content — Flameless atomic absorption spectrometric method*

ISO 6634, *Fruits, vegetables and derived products — Determination of arsenic content — Silver diethyldithiocarbamate spectrophotometric method*

ISO 6637, *Fruits, vegetables and derived products — Determination of mercury content — Flameless atomic absorption method*

ISO 7563, *Fresh fruits and vegetables — Vocabulary*

ISO 7952, *Fruits, vegetables and derived products — Determination of copper content — Method using flame atomic absorption spectrometry*

ISO 9526, *Fruits, vegetables and derived products — Determination of iron content by flame atomic absorption spectrometry*

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ISO 17239, *Fruits, vegetables and derived products — Determination of arsenic content — Method using hydride generation atomic absorption spectrometry*

3 Definitions

For the purposes of this standard, the terms and definitions in ISO 7563, and the following terms and definitions apply.

3.1

jackfruit

The compound fruit of *Artocarpus heterophyllus* Lamarck, generally known as Fenesi in Kiswahili.

3.2

similar varietal characteristics

The fruits in any lot are similar in appearance and characteristics.

3.3

mature

The fruit has reached a stage of development which will ensure proper completion of the ripening process with the spines being well-developed and spread out.

3.4

overripe

the rind is soft and the flesh is mashy

3.5

clean

free from adhering soil, dirt, latex, pest and foreign matter

3.6

well-trimmed

The stem is firmly attached and cut off fairly smooth at approximately right angles to the longitudinal axis of the stem at a point not more than 5 cm beyond the shoulder of this fruit.

3.7

fairly well formed

this fruit has the typical shape of the variety and is not excessively constricted or excessively stubby

3.8

damage

any defect or combination of defects of physical or physiological causes which detracts from the edible or marketing quality such as scars or bruises

3.9

badly misshapen

the jackfruit is badly constricted or very stubby or otherwise so malformed

3.10

serious damage

any defect or combination of defect of physiological or physical (external or internal causes such as cuts punctures and internal dehydration which could lead to the abnormally quick deterioration of the fruit and cause rejection

3.11

major defects

- **Insects** With evidence of live insects or insect infestation.
- **Diseases** With evidence of fungal or bacterial rots.
- **Physical / pest damage** With unhealed cuts, holes or splits from physical or pest damage.

- **Physiological disorders** With large areas of brown discolouration (latex leakage).
With evidence of dry hard flesh or flesh lifting from shell (dehydration).
With angular skin segments and glossy green skin colour (excessive immaturity)
- **Temperature injury** With strong odour (excessive maturity).
With skin browning/blackening and areas of softened flesh (chilling injury).

3.12

minor defects

- physical/pest damage — *With superficial bruising > 2 sq cm.*
- Skin marks / blemishes — *With healed scars > 2 sq cm.*

4 Provisions concerning quality

4.1 General

The purpose of the standard is to define the quality requirements of jack fruits at the market-control stage, after preparation and packaging.

The holder/seller of products may not display such products or offer them for sale, or deliver or market them in any manner other than in conformity with this standard. The holder shall be responsible for observing such conformity.

4.2 Minimum requirements

4.2.1 In all classes, subject to the special provisions for each class and the tolerances allowed, the jackfruit shall be:

- (a) whole/intact, firm and of similar varietal characteristics;
- (b) sound, produce affected by rotting or deterioration such as to make it unfit for consumption is excluded;
- (c) clean and practically free of any visible foreign matter;
- (d) practically free of pests and diseases, and internal damage caused by them affecting the general appearance of the produce;
- (e) practically free of mechanical and/or physiological damage;
- (f) free of abnormal external moisture, excluding condensation following removal from cold storage;
- (g) free of any foreign smell and/or taste;
- (h) free of damage caused by low and/or high temperatures;
- (i) free of damage caused by frost;
- (j) free of signs of internal shrivelling;
- (k) practically free of bruising and blemishes and/or extensive healed-over cuts.

4.2.2 The stem or peduncle is firmly attached and well-trimmed, not more than 5 cm beyond the shoulder of the fruit.

4.2.3 The jackfruits must have been carefully picked and have reached an appropriate degree of development and ripeness account being taken of the characteristics of the variety, the time of picking and the area in which they are grown.

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4.2.4 The development and condition of the jackfruits must be such as to enable them:

- (a) to withstand transport and handling; and
- (b) to arrive in satisfactory condition at the place of destination.

4.3 Maturity criteria

The maturity of jackfruits is defined by the following parameters:

- Colouring — Light green to yellow skin with light brown markings, yellow flesh
- Cooking varieties are mature when skin is yellow with brown markings, fruit remains firm. Fresh eating varieties are mature when skin and stem are slightly yellowing, starch levels are low, flesh softening.
- Shape — Generally oval to oblong, slightly irregular shape
- General appearance — Rough skin composed of small spiny segments; skin often with brownish latex stains; short stem present with clean cut
- Sensory — Starchy brown seeds surrounded by sweet aromatic flesh which divides easily into segments; flesh texture may be soft and mucilaginous or firm depending on variety; when fully ripe the fruit emits a strong odour.
- Size — < 500 mm long and 250 mm wide

4.4 Classes

Jackfruit is classified in three classes defined below:

4.4.1 “Extra” Class

Jackfruit in this class must be of superior quality. It must be characteristic of the variety and/or commercial type. It must be practically free of defects provided that these do not affect the general appearance of the produce, the quality, the keeping quality and presentation in the package.

4.4.2 Class I

Jackfruit in this class must be of good quality. It must be characteristic of the variety and/or commercial type. The following defects, however, may be allowed, provided these do not affect the general appearance of the produce, the quality, the keeping quality and presentation in the package:

- (a) slight defects of colour and shape;
- (b) slight defect on the skin and other superficial defects not exceeding 10% of the total surface area.

The defects must not, in any case, affect the flesh of the fruit.

4.4.3 Class II

This class includes jackfruits which do not qualify for inclusion in the higher classes, but satisfy the minimum requirements specified in 4.2. The following, however, may be allowed, provided the jackfruit retains its essential characteristics as regards the quality, the keeping quality and presentation:

- (a) defects in shape and colour;
- (b) defects on the skin and other superficial defects not exceeding 15% of the total surface area.

The defects must not, in any case, affect the flesh of the fruit.

5 Provisions concerning sizing

Size is determined by weight with the following table.

Size Code	Weight (kg)
1	>25
2	21-25
3	16-20
4	10-15
5	<10

6 Provisions concerning tolerances

Tolerances in respect of quality and size shall be allowed in each retail package (or lot for produce presented in bulk) for produce not satisfying the requirements of the class indicated.

6.1 Quality tolerances

6.1.1 "Extra" Class

Five per cent by number of jackfruit not satisfying the requirements of the class, but meeting those of Class I or, exceptionally, coming within the tolerances of that class.

6.1.2 Class I

Ten per cent by number of jackfruit not satisfying the requirements of the class, but meeting those of Class II or, exceptionally, coming within the tolerances of that class.

6.1.3 Class II

Ten per cent by number of jackfruit satisfying neither the requirements of the class nor the minimum requirements, with the exception of produce affected by rotting or any other deterioration rendering it unfit for consumption.

6.2 Size tolerances

For all classes, 10% by number or weight of jackfruit corresponding to the size immediately above or below those indicated in Clause 5.

7 Provisions concerning presentation

7.1 Uniformity

The contents of each package must be uniform and contain only jackfruits of the same origin, variety and/or commercial type, quality and size, and appreciably of the same degree of maturity and development. The visible part of the contents of the package must be representative of the entire contents.

7.2 Packaging

Jackfruits must be packed in such a way as to protect the produce properly. The materials used inside the package must be new¹, clean, and of a quality such as to avoid causing any external or internal

¹ For the purposes of this Standard, this includes recycled material of food-grade quality.

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damage to the produce. The use of materials, particularly of paper or stamps bearing trade specifications is allowed, provided the printing or labelling has been done with non-toxic ink or glue.

Jackfruits shall be packed in each container in compliance with CAC/RCP 44.

7.2.1 Description of containers

The containers shall meet the quality, hygiene, ventilation and resistance characteristics to ensure suitable handling, shipping and preserving of the jackfruits. Packages must be free of all foreign matter and smell.

8 Marking or labelling

8.1 Consumer packages

In addition to the requirements of ARS 56, the following specific provisions apply:

8.1.1 Nature of produce

If the produce is not visible from the outside, each package (or lot for produce presented in bulk) shall be labelled as to the name of the produce and may be labelled as to the name of the variety and/or commercial type.

8.2 Non-retail containers

Each package must bear the following particulars, in letters grouped on the same side, legibly and indelibly marked, and visible from the outside, or in the documents accompanying the shipment.

8.2.1 Identification

Name and address of exporter, packer and/or dispatcher. Identification code (optional).²

8.2.2 Nature of produce

Name of the produce if the contents are not visible from the outside. Name of the variety and/or commercial type (optional).³

8.2.3 Origin of produce

Country of origin and, optionally, district where grown or national, regional or local place name.

8.2.4 Commercial identification

- Class and variety;
- Number of fruit container (count);
- Grower/lot identification number;
- If appropriate, a statement indicating the use of preservatives;
- Storage temperature
- Net weight of package (kg).

² The national legislation of a number of countries requires the explicit declaration of the name and address. However, in the case where a code mark is used, the reference "packer and/or dispatcher (or equivalent abbreviations)" has to be indicated in close connection with the code mark.

³ The national legislation of a number of countries requires the explicit declaration of the variety.

8.2.5 Official Inspection Mark (optional)

9 Contaminants

9.1 Heavy metals

Jackfruits shall comply with those maximum levels for heavy metals established by the Codex Alimentarius Commission for this commodity.

9.2 Pesticide residues

Jackfruits shall comply with those maximum pesticide residue limits established by the Codex Alimentarius Commission for this commodity.

10 Hygiene

10.1 It is recommended that the produce covered by the provisions of this Standard be prepared and handled in accordance with the appropriate sections of ARS 53, CAC/RCP 53, and other relevant Codex texts such as Codes of Hygienic Practice and Codes of Practice.

10.2 The produce should comply with any microbiological criteria established in accordance with CAC/GL 21.



Jackfruit — attachment styles



Jackfruit — Fruiting styles



Jackfruits — Fruit shapes



Aged jackfruit trees

Annex B (informative)

Post-harvest handling and processing

C.1 Post-harvest handling

Tender fruits

These are generally handled by vegetable dealers and shopkeepers.

- Avoid damage to the skin which causes browning, resulting in poor external appearance.
- The cut stalk will exude latex, which permanently stains clothing. When latex exudation stops, wrap the fruits individually in newspapers and pack them in a suitable container.

Mature fruits

- Mechanical damage, exposure to sunlight and rough handling during transport reduce the fruit quality.
- Induced ripening is not necessary for matured fruits.

7.2 Processing and packaging

Post-harvest operations

- Remove immature, over-ripe, damaged and misshapen fruits.
- Grade the remaining fruits according to size as follows:
 - Large: weighing 16 kg and above.
 - Medium: weighing 8 kg to 16 kg.
 - Small: weighing below 8 kg.
- Wash fruits using chlorinated water (100 ppm) to remove dirt, latex stains and any field contamination.
- Drain fruits properly to remove excess moisture from the surface of the fruit for further processing or storing.

Packaging and storage of fresh fruits

- Pack graded and washed fruits into plastic containers or bamboo baskets for storage.
- Freshly harvested ripe fruits can be stored for 4 to 5 days at 25 – 35 °C.
- Fruits can be kept for 2 to 6 weeks at 11 – 13 °C and relative humidity of 85 – 95 %, depending on cultivar and maturity stage.
- Jackfruits stored at temperatures below 12 °C before transfer to higher temperatures show injury due to chilling. This includes dark-brown discolouration of the skin, pulp browning, deterioration in flavour and increased susceptibility to decay.

Ripening

- Prior to pre- or minimal processing, jackfruits should be ripened fully to achieve optimum aroma, sweetness, taste and eating quality.

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- Keep mature jackfruits at 24 – 27 °C. They will ripen within 3 to 4 days. However, uneven ripening is a major problem in the natural ripening process, especially for large-sized fruits.
- To achieve more uniform ripening, expose fruits to 50 ppm ethylene for 24 hours at 25 °C. The fruits ripen within 3 to 4 days after the treatment with ethylene gas when kept at room temperature.

Pre-processing into fruitlets

- Cut fruits in half lengthwise. Latex may exude from the cut surfaces when extracting the flesh. Coat hands, knives and work surfaces with vegetable oil to make clean-up easier.
- Carve out the sticky central core.
- Scoop out the individual fruitlets (bulbs).
- Sort bulbs according to the required size, maturity and colour. Only full bulbs, (not half or partly cut) are recommended for retailing.
- Cut the end of the bulbs to remove the seeds according to consumers' preference.
- Pack fruitlets for storage or direct consumption.

Packaging and storage of jackfruit fruitlets

- Pack bulbs in polythene bags and heat-seal them, or in polypropylene containers with lids. They can be kept for 3 weeks if kept cool, at 12 °C.
- Maintain a temperature of 12 °C throughout the distribution process to avoid deterioration.

Pre-processing into pulp

- Crush de-seeded jackfruit bulbs using a blender.
- Add 40 – 45 g of powdered sugar to every 100 g of smashed pulp and mix thoroughly.
- Dry mixture in a hot air drier at 80 – 85 °C until moisture content reaches 20 – 22 %.
- Place pulp in plastic containers and seal.
- Freeze pulp and store for further processing.

Annex D (informative)

Informative details of jackfruit

D.1 Climatic requirements for jackfruit

Jackfruit can grow from sea level to 1600 m elevation. However, fruit quality is better at lower elevation.

- Jackfruit is well adapted to hot, humid tropics and a humid subtropical climate. Temperatures ranging between 16 to 28 °C are considered good for its growth. However, optimum growth and production occurs in continuously warm areas.
- Jackfruit cannot tolerate freezing temperature. It requires watering during long dry periods for optimum growth and production. The climatic requirements for cultivation of jackfruit are summarized in Table D.1.

Table D.1 — Climatic requirements for jackfruit

Climatic factor	Minimum	Maximum
Altitude (m)	Sea level	1600
Annual rainfall (mm)	1000	2400
Mean annual temperature (°C)	16	28

D.2 Site requirements

Jackfruit grows in a wide variety of conditions.

- Soil — Jackfruit can grow on a wide variety of soil, but grows best on deep alluvial soil. Soil drainage is very important. It cannot tolerate waterlogged conditions. The tree may die in 2 – 3 days in flooded soil conditions. The general physical soil requirements of the jackfruit tree are shown in Table D.2.
- Light — The tree grows well in full light.

Table D.2 — Suitable habitats for jackfruit

Characteristics	Suitable habitats
Soil type (texture)	Deep alluvial, sandy loam, clay loam, calcareous, lateritic
Topography	Plains to highland, up to 30° slopes observed
Rooting depth	25 cm deep, 2.25 m in spread
Drainage	Well drained
Soil pH	5.0 – 7.5

D.3 Land-use systems

- Jackfruit can be grown in homesteads, community places, by the roadside and in orchard plantations.

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- Forest land. In certain countries it is still abundant in forests. It can be used for reforestation programmes while serving as a fruit tree.
- Jackfruit fits well in agroforestry systems. Jackfruit tree is interplanted with annual crops such as vegetables, pineapple and spices, and also with other perennial species such as coconut, cocoa, pepper, etc., in household and secondary agroforestry systems.
- Boundary tree. Used to maintain the boundaries of land by planting on dykes created between fields.
- A component of both village forests and home gardens, jackfruit trees form part of the middle layer of the upper canopy along with other fruit trees.

D.4 Nutritional value

Both tender and ripe fruits and the seeds are rich in minerals and vitamins. Ripe fruits are rich in vitamin A, which maintain good vision. Vitamin B complex helps convert food into energy. Iron, is present in blood, which is involved in the movement of oxygen through the body. The nutritive value of jackfruit is presented in Table D.3.

Table D.3 — Nutritive value of jackfruit per 100 g edible portion

Constituents	Pulp		Mature seed
	Tender	Ripe	
Moisture (%)	84.0	77.2	64.5
Carbohydrate (g)	9.4	18.9	25.8
Protein (g)	2.6	1.9	6.6
Fat (g)	0.3	0.1	0.4
Fibre (g)	4.4	1.1	1.3
Total mineral matter (g)	0.9	0.8	1.2
Calcium (mg)	50.1	20.0	21.0
Phosphorus (mg)	97.0	30.0	28.0
Iron (mg)	1.5	500.1	0.8
Potassium (mg)	206.0	350.0	246.0
Vitamin A (IU)	0.0	540.0	17.0
Thiamin (mg)	0.2	30.0	0.2
Riboflavin (mg)	0.1	0.1	0.1
Nicotinic acid (mg)	0.2	0.4	0.3
Vitamin C (mg)	11.0	7.0	11.0
Calorific value	50.0	84.0	139.0

D.5 Medicinal value

Parts of jackfruit trees are used in traditional medicine throughout the tropics. However, no major clinical evidence is available to support these uses and a medical practitioner should be consulted.

— **Roots**

- An extract of roots is used in treating skin diseases, asthma and diarrhoea.

— **Leaves**

- An extract from leaves and latex treats asthma, prevents ringworm infestation, and heals cracking of the feet.
- An infusion of mature leaves and bark is used to treat diabetes and gall stones.
- A tea made with dried and powdered leaves is taken to relieve asthma.
- Heated leaves can treat wounds, abscesses and ear problems, and relieve pain.

— **Bark**

- An extract from bark or rags (the non-edible portion of ripe fruits) or roots is used in the treatment of dysentery and release of the placenta after calving in cows.
- Ashes produced by burning bark can treat abscesses and ear problems.
- Extract from seeds or bark helps digestion.

— **Other uses**

- Crushed inflorescence is used to reduce bleeding in open wounds.
- Ripe fruits can be used as a laxative.

— **Seeds**

- Extract from freshly extracted seeds is used to treat diarrhoea and dysentery.

D.6 Fuel and timber

- Jackfruit trees yield valuable timber for making high quality furniture, for house construction, masts, oars and musical instruments.
- The fallen leaves and pruned twigs and branches can be used as household fuel.

D.7 Fodder

Leaves are a useful fodder for goats.

D.8 Ecological and environmental value

- The jackfruit canopy provides perennial cover to the soil, acting as a shade tree and absorbing the impact of rain on the soil.
- Soil fertility is improved if fallen leaves are allowed to rot and incorporated in to the soil.
- Weed growth is reduced when leaf mulches are used.
- The action of roots particularly taproots growing into soil benefits soil structure by reducing compaction, and facilitates soil conservation.
- The tree can reduce the effects of wind planted around a homestead.

D.9 Major pests and diseases of jackfruit and their control

Common name	Scientific name	Nature of attack	Bio-control	Other controls
Shoot and fruit borer	<i>Diaphania caesalis</i>	Initial stage: small hole with fresh excreta. Wetting of affected parts	Cover fruits with polythene bags Remove affected parts. Prune canopy.	Carbaryl @ 4 g/l
Bud weevil	<i>Ochyromera artocarpi</i>	Grubs bore into flower buds and fruits and induce premature drop Adult eat the leaves	Remove affected parts. Prune canopy	
Blossom rot / Fruit rot /Stem rot	<i>Rhizopus artocarpi</i>	Inflorescence / flowering shoot tips / fruit stalks blackened by sporangia Flowers and fruits rot and drop	Remove affected parts. Prune canopy.	Folicur or Tilt 250 EC @ 0.5 ml/l

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